



Appl. No. 10/675,126
HSJ920030026US2/(HITG.053-0522)
Amdt. Dated April 20, 2006
Reply to Office Action of January 31, 2006

In the Claims

The following is a complete listing of the claims and replace all prior claims in the application:

- 1 1. (Currently Amended) A method of forming a spin valve sensor, comprising:
2 forming a ferromagnetic free layer structure that has a magnetic moment;
3 forming a ferromagnetic pinned layer structure having a magnetic moment;
4 forming a nonmagnetic conductive spacer layer between the free layer structure and
5 the pinned layer structure;
6 forming an anti-ferromagnetic pinning layer coupled to the pinned layer structure for
7 pinning the magnetic moment of the pinned layer structure;
8 forming hard magnetic thin films on both sides of at least a portion of the free layer
9 structure, the ferromagnetic pinned layer structure, the nonmagnetic conductive spacer layer
10 and the anti-ferromagnetic pinning layer; and
11 forming a hard bias seedlayer structure adjacent to and on opposite sides of at least a
12 portion of the free layer structure, the ferromagnetic pinned layer structure, the nonmagnetic
13 conductive spacer layer and the anti-ferromagnetic pinning layer, wherein the forming the
14 hard bias seedlayer structure comprises forming at least a first layer comprising silicon and a
15 second layer comprising chromium or chromium molybdenum.

- 1 2. (Original) The method of claim 1, wherein the forming the anti-
2 ferromagnetic pinning layer further comprising forming a layer of platinum manganese.

1 3. (Original) The method of claim 1, wherein the forming the hard bias
2 seedlayer structure further comprises forming a layer of tantalum adjacent the silicon layer.

1 4. (Original) The method of claim 3, wherein the forming a layer of tantalum
2 adjacent the silicon layer further comprises forming the tantalum and silicon layer with equal
3 thickness.

1 5. (Original) The method of claim 3, wherein the forming a layer of tantalum
2 adjacent the silicon layer further comprises forming the tantalum layer with a thickness half a
3 thickness of the silicon layer.

1 6. (Original) The method of claim 3, wherein the forming a layer of tantalum
2 further comprises forming a tantalum-chromium alloy layer.

1 7. (Original) The method of claim 6, wherein the forming the tantalum-
2 chromium alloy layer further comprises forming the tantalum-chromium alloy layer and the
3 silicon layer with equal thickness.

1 8. (Original) The method of claim 6, wherein the forming the tantalum-
2 chromium alloy layer further comprises forming the tantalum-chromium alloy layer with a
3 thickness half a thickness of the silicon layer.

1 9. (Currently Amended) The method of claim 1, wherein the forming the hard
2 bias seedlayer structure further comprises forming at opposite sides of at least a portion of the
3 free layer structure, the ferromagnetic pinned layer structure, the nonmagnetic conductive
4 spacer layer and the anti-ferromagnetic pinning layer, a first layer of tantalum, a second layer
5 of silicon and a third layer comprising chromium.

1 10. (Currently Amended) The method of claim 1, wherein the forming the hard
2 bias seedlayer structure further comprises forming at opposite sides of at least a portion of the
3 free layer structure, the ferromagnetic pinned layer structure, the nonmagnetic conductive
4 spacer layer and the anti-ferromagnetic pinning layer, a first layer of tantalum, a second layer
5 of silicon and a third layer comprising chromium-molybdenum.

1 11. (Currently Amended) A method of forming a spin valve sensor, comprising:
2 forming a spin valve structure including a ferromagnetic free layer, a ferromagnetic
3 pinned layer and an anti- ferromagnetic pinning layer;
4 forming hard magnetic thin films adjacent at least a portion of the spin valve structure
5 on both sides of the spin valve structure; and
6 forming a hard bias seedlayer structure adjacent to and on opposite sides of at least a
7 portion of the spin valve structure, wherein the forming the hard bias seedlayer structure
8 comprises forming at least a first layer comprising silicon and a second layer comprising
9 chromium or chromium molybdenum.

1 12. (Original) The method of claim 10, wherein the pinning layer comprises
2 platinum manganese.

1 13. (Original) The method of claim 10, wherein the forming the hard bias
2 seedlayer structure further comprises forming a layer of tantalum adjacent the silicon layer.

1 14. (Original) The method of claim 13, wherein the forming a layer of
2 tantalum adjacent the silicon layer further comprises forming the tantalum and silicon layer
3 with equal thickness.

1 15. (Original) The method of claim 13, wherein the forming a layer of
2 tantalum adjacent the silicon layer further comprises forming the tantalum layer with a
3 thickness half a thickness of the silicon layer.

1 16. (Original) The method of claim 13, wherein the forming a layer of
2 tantalum further comprises forming a tantalum-chromium alloy layer.

1 17. (Original) The method of claim 16, wherein the forming the tantalum-
2 chromium alloy layer further comprises forming the tantalum-chromium alloy layer and the
3 silicon layer with equal thickness.

1 18. (Original) The method of claim 16, wherein the forming the tantalum-
2 chromium alloy layer further comprises forming the tantalum-chromium alloy layer with a
3 thickness half a thickness of the silicon layer.

1 19. (Currently Amended) The method of claim 11, wherein the forming the hard
2 bias seedlayer structure further comprises forming at opposite sides of at least a portion of the
3 free layer structure, the ferromagnetic pinned layer structure, the nonmagnetic conductive
4 spacer layer and the anti-ferromagnetic pinning layer, a first layer of tantalum, a second layer
5 of silicon and a third layer comprising chromium.

1 20. (Currently Amended) The method of claim 11, wherein the forming the hard
2 bias seedlayer structure further comprises forming at opposite sides of at least a portion of the
3 free layer structure, the ferromagnetic pinned layer structure, the nonmagnetic conductive
4 spacer layer and the anti-ferromagnetic pinning layer, a first layer of tantalum, a second layer
5 of silicon and a third layer comprising chromium-molybdenum.

1 21. (Currently Amended) A method of forming a hard bias seedlayer structure,
2 comprising:
3 forming a first layer comprising silicon adjacent to and on opposite sides of a spin
4 valve structure; and
5 forming a second layer comprising chromium or chromium molybdenum adjacent to
6 the first layer.

1 22. (Original) The method of claim 21 further comprising forming a layer of
2 tantalum adjacent the silicon layer.